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CENTRAL INTELLIGENCE AGENCY
INFORMATION FROM
FOREIGN DOCUMENTS OR RADIO BROADCASTS

50X1-HUM

COUNTRY USSR

SUBJECT Scientific - Cosmic rays

HOW PUBLISHED Monthly periodical

WHERE PUBLISHED Moscow

DATE PUBLISHED February 1947

LANGUAGE Russian

DATE OF INFORMATION 1947

DATE DIST. 12 Sep 1949

NO. OF PAGES 3

SUPPLEMENT TO REPORT NO.

THIS IS UNEVALUATED INFORMATION

SOURCE Uspekhi Fizicheskikh Nauk, Vol XXXI, No 2, 1947, (FDB Per Ann 32T100).

DATA ON COSMIC RAYS DISCUSSED

The regular meeting of the Department of Physicomathematical Sciences of the Academy of Sciences USSR on January 23, 1947 was entirely devoted to a discussion of new data, obtained during 1946, on cosmic rays.

At the morning meeting were read the works of the Alagoz High-Altitude Expedition of the Academy of Sciences Armenian SSR, made jointly with the Academy of Sciences USSR. The expedition had investigated and established, beyond all question, the existence of a new elementary particle with a mass intermediate between the masses of the meson and proton.

A. I. Alikhanyan, Corresponding Member, Academy of Sciences USSR, recalled in his report that the Alagez Expedition had demonstrated in its previous studies the presence in cosmic rays of a "third" component, apart from the so-called "hard" and "soft" components, whose nature was still unknown. It was demonstrated, in particular, that the "third" component generates particles with ionization power two to three times higher than the ionization power of relativistic mesons.

In 1946, Alikhanyan, Alikhanov, and Vaysenberg conducted, at an altitude of 3,200 meters, an extremely accurate investigation of the deviation of the components of cosmic radiation in the magnetic field (4,000 oersteds). The particles were sorted by means of a 5.4-centimeter lead plate; the latter process made it possible to separate the hard meson component.

It was established that of the aggregate stream of particles, approximately 10 percent were particles with slight deviation in a magnetic field and, at the same time, with small penetrating power. It was established by special tests that the particles could not belong to any type already known. Starting from the values of the impulse (found from the deviation in a magnetic field) and energy of the particle (obtained from measuring its penetrating power), their mass was estimated to lie in the interval from 600 to 900 electron masses. The particles carry both positive and negative charges, but the number of particles with a positive charge is somewhat greater than those with a negative charge. The newly discovered particle was given the name "baritron." The experimental data point to the possibility of existence of baritrons with different mass up to a size exceeding the proton's mass.

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S. Ya. Nikitin, candidate in Physicomathematical Sciences reported on the results of his investigation of the ionization spectrum of cosmic rays with the aid of an ionization telescope. A proportional counter permitted the measurement of the value of ionization impulses while the Geiger counter made it possible to carry on simultaneous control of the number of ionizing particles. The reporter was able to obtain the ionization spectrum of "soft" and "hard" components and to discover the complete dissimilarity of these spectrums. It was demonstrated that about 15 percent of the particles (in relation to the intensity of the hard component) entering into the body of a soft component produce ionization three times greater than do mesons.

Computing the masses of the particles on the basis of their penetrating and ionizing powers produced a value lying in the interval from 300 to 3,500 electron masses in accordance with the three maximums in the ionization spectrum. The investigation of absorption of these particles in lead had shown that the absorption curve was of unusual form.

It also was demonstrated that the particles' presence fully explains the divergence of the number of particles as determined by methods of ionization chambers and meters.

Thus, it should be admitted as a firmly established fact that in cosmic rays there is present a new, until now unknown, kind of elementary particle, the baritron, with a mass of 400 - 900 electron masses. The baritron's small penetrating power forces one to suppose that it is generated near the measuring equipment by the "third" component, which could also be the cause of generation of "stars."

At the evening meeting V. I. Veksler, Corresponding Member, Academy of Sciences USSR, reported on certain new data on the composition of cosmic rays. This data was culled from information obtained in 1946 by the Pamir Expedition of the Institute of Physics, Academy of Sciences USSR. The work was conducted at an altitude of 4,800 meters. The basic objective of the series of investigations was to determine the nature of radiation causing nuclear fission.

Kurnosova and Lubimov reported on their discovery that in a thick layer of lead (10 centimeters and more), showers are generated which are different from delta showers caused by ordinary mesons. The close correlation between the showers caused by baritrons and narrow atmospheric showers was established at the same time. It was shown by very careful measurment that the component generating showers in lead was absorbed in dense matter considerably less than in the equivalent thickness of air. The latter phenomenon could be explained either by disintegration of the generating particles (however, insofar as they could not be ordinary mesons, they must be some new particles) or, less probable, by the presence of a complicated transitional effect. There are reasons to suppose that the formation of the particular showers discovered is connected with nuclear fission.

Shcherbakova and Besotosniy had established, with the aid of proportional counters, a close correlation between nuclear fission and narrow atmospheric showers, which points to the presence in the latter of a component extremely effective with respect to the generation of nuclear fission. In agreement with data obtained by other scientific workers (and by different methods), it was shown that a considerable number of particles forming the generating component are nonionizing.

Gorbunov worked out a third method of studying nuclear fission by using coupled proportional counters of special design. He had established the fact that the basic part of a component generating nuclear fission has penetrating power. Preliminary indications of the possibility of the generating component's disintegrating were obtained on the basis of degree of absorption in dense matter and in the atmosphere.

At an altitude of 3,860 meters the stream of [illegible] was found to be of the same order as the stream of [illegible], the inevitable conclusion that the generating particles [illegible].

The sum total of the reported experiments and [illegible] to light a series of new phenomena closely related to [illegible] rays, probably indicating the existence of a new, unstable, and [illegible] neutral particle.

Those taking part in the discussion were Academicians A. I. Alikhanov and V. A. Fok, Corresponding Member B. M. Vull, Doctors of Physicomathematical Sciences N. A. Dobrotin and S. Z. Belen'skiy, Professors V. L. Ginzburg and D. D. Ivanenko, and others.

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